CLAIMS

What is claimed is:

1. A magnetic-field sensor device comprising:

at least two electrodes;

an insulating layer separating said at least two electrodes; and

at least one layer of chemically-synthesized magnetic nanoparticles disposed between said at least two electrodes.

2. The magnetic-field sensor device of claim 1, wherein said at least two electrodes comprise a magnetic material.

3. The magnetic-field sensor device of claim 1, wherein at least one of said at least two electrodes comprises a magnetic material.

4. The magnetic-field sensor device of claim 1, wherein at least one of said at least two electrodes is one of a non-magnetic metal and a semiconductor.

5. The magnetic-field sensor device of claim 1, wherein said chemically-synthesized magnetic nanoparticles range in size between 2 nm and 20 nm in diameter.

6. The magnetic-field sensor device of claim 1, wherein said chemically-synthesized magnetic nanoparticles are oriented with a magnetic-moment orientation parallel to a direction of current flow through said chemically-synthesized magnetic nanoparticles.

7. The magnetic-field sensor device of claim 1, wherein said chemically-synthesized magnetic nanoparticles are oriented with a magnetic-moment orientation perpendicular to a direction of current flow through said chemically-synthesized magnetic nanoparticles.

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8. The magnetic-field sensor device of claim 1, wherein said at least one layer of chemically-synthesized magnetic nanoparticles comprises at least one chemically-synthesized magnetic nanoparticle.

9. The magnetic-field sensor device of claim 1, wherein said chemically-synthesized magnetic nanoparticles comprise elements comprising one of Co, Fe, Ni, Mn, Cr, Nd, Pr, Pt, Pd, Ho, Gd, Eu, Er, Re, Rh, an intermetallic compound of said elements, a binary alloy of said elements, a ternary alloy of said elements, an oxide comprising one of Fe, Co, Ni, Mn, and Cr, and a mixed oxide combining at least one of Fe, Co, Ni, Mn, and Cr, with at least one of La, Sr, Ba, and Cu.

10. The magnetic-field sensor device of claim 1, wherein said insulating organic layer separates one chemically-synthesized magnetic nanoparticle layer from another chemically-synthesized magnetic nanoparticle layer.

11. A magnetic-field sensor device comprising:

at least two electrodes;

an insulating layer separating said at least two electrodes; and

at least one layer of chemically-synthesized magnetic nanoparticles disposed between said at least two electrodes;

wherein said at least two electrodes comprise a magnetic material.

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12. The magnetic-field sensor device of claim 11, wherein at least one of said at least two electrodes comprises a magnetic material.

13. The magnetic-field sensor device of claim 11, wherein at least one of said at least two electrodes is one of a non-magnetic metal and a semiconductor.

14. The magnetic-field sensor device of claim 11, wherein said chemically-synthesized magnetic nanoparticles range in size between 2 nm and 20 nm in diameter.

15. The magnetic-field sensor device of claim 11, wherein said chemically-synthesized magnetic nanoparticles are oriented with a magnetic-moment orientation parallel to a direction of current flow through said chemically-synthesized magnetic nanoparticles.

16. The magnetic-field sensor device of claim 11, wherein said chemically-synthesized magnetic nanoparticles are oriented with a magnetic-moment orientation perpendicular to a direction of current flow through said chemically-synthesized magnetic nanoparticles.

17. The magnetic-field sensor device of claim 11, wherein said at least one layer of chemically- synthesized magnetic nanoparticles comprises at least one chemically-synthesized magnetic nanoparticle.

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18. The magnetic-field sensor device of claim 11, wherein said chemically-synthesized magnetic nanoparticles comprise elements comprising one of Co, Fe, Ni, Mn, Cr, Nd, Pr, Pt, Pd, Ho, Gd, Eu, Er, Re, Rh, an intermetallic compound of said elements, a binary alloy of said elements, a ternary alloy of said elements, an oxide comprising one of Fe, Co, Ni, Mn, and Cr, and a mixed oxide combining at least one of Fe, Co, Ni, Mn, and Cr, with at least one of La, Sr, Ba, and Cu.

19. The magnetic-field sensor device of claim 10, wherein said insulating organic layer separates one chemically-synthesized magnetic nanoparticle layer from another chemically-synthesized magnetic nanoparticle layer.

20. A method of forming a magnetic-field sensor device, said method comprising:

depositing a first electrode onto a substrate;

depositing an electrically insulating layer on said first electrode;

removing a portion of said electrically insulating layer to expose a region of said first electrode;

depositing at least one layer of chemically-synthesized nanoparticles on said electrically insulating layer and said exposed region of said first electrode; and

depositing a second electrode on said chemically-synthesized nanoparticles and said electrically insulating layer.

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21. The method of claim 20, wherein said substrate comprises one of a conducting material and a non-conducting material.

22. The method of claim 20, wherein said first and second electrodes comprise an electrically conducting and magnetic material.

23. The method of claim 20, further comprising depositing a layer of magnetic material on said substrate.

24. The method of claim 20, wherein said chemically-synthesized nanoparticles comprise elements comprising one of Co, Fe, Ni, Mn, Cr, Nd, Pr, Pt, Pd, Ho, Gd, Eu, Er, Re, Rh, an intermetallic compound of said elements, a binary alloy of said elements, a ternary alloy of said elements, an oxide comprising one of Fe, Co, Ni, Mn, and Cr, and a mixed oxide combining at least one of Fe, Co, Ni, Mn, and Cr, with at least one of La, Sr, Ba, and Cu.

25. A method of forming a magnetic-field sensor device, said method comprising:

depositing a first electrode onto a substrate;

depositing an electrically insulating layer on said first electrode;

depositing a second electrode on said electrically insulating layer;

removing a portion of said electrically insulating layer to create an empty space;

depositing at least one layer of chemically-synthesized nanoparticles in said empty space; and

removing said substrate.

26. The method of claim 25, wherein said substrate comprises one of a conducting material and a non-conducting material.

27. The method of claim 25, wherein said first and second electrodes comprise an electrically conducting and magnetic material.

28. The method of claim 25, wherein said chemically-synthesized nanoparticles comprise elements comprising one of Co, Fe, Ni, Mn, Cr, Nd, Pr, Pt, Pd, Ho, Gd, Eu, Er, Re, Rh, an intermetallic compound of said elements, a binary alloy of said elements, a ternary alloy of said elements, an oxide comprising one of Fe, Co, Ni, Mn, and Cr, and a mixed oxide combining at least one of Fe, Co, Ni, Mn, and Cr, with at least one of La, Sr, Ba, and Cu.